Space Weather Technical Forecast

Issued on Thursday, 07 March 2024 at 13:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storms on day 2 and 3 (08-09 Mar) given likely HSS arrival and possible glancing CME.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity remains Low with the peak flare a C8.3 at 07/0618UTC from AR3599. There are six numbered and one unnumbered sunspot regions on the visible disc. AR3599, now Dai/Beta-Gamma-Delta, continues to be the most magnetically complex and has developed a small delta spot within its intermediate region with an increase in flare activity. The remaining regions are small and generally stable.

No Earth directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters observed by ACE/DSCOVR at L1 were at slightly elevated to slow ambient levels around 380-440km/s. Density initially below average, increased to briefly above average levels around 07/0000UTC, peaking around 17ppcc before trending down through the remainder of the period to current weak levels. Total magnetic field strength has been weak throughout +2/+6nT. The north-south component has varied weakly throughout between +5nT and -5nT. Phi angle has been primarily negative (away from the Sun) but became more mixed from around 07/0000UTC. Geomagnetic activity was mostly quiet (Kp0-2) with a brief period of unsettled (Kp3).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was predominantly at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence was level at 06/0000UTC was 1.23e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Expected to remain generally low with a slight chance of an isolated M-class flare.

Solar Wind / Geomagnetic Activity: A CME, originating from filament lift off in the southeast disk on the 05 Mar, brings a risk of a glancing blow later on day 2 (08 Mar) or into early day 3 (09 Mar).

Otherwise the Earth is in a reasonably slow-ambient solar wind environment with the next main enhancement expected from a negative polarity coronal hole, CH06/-, currently moving into the western disc. This is forecast to connect with Earth sometime later into day 2 (08 Mar) and persist into day 3 (09 Mar), with solar winds perhaps reaching elevated levels. Geomagnetic activity from this feature could see a greater risk for a strong connection as Earth moves closer to the March equinox.

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Generally Quiet to Unsettled geomagnetic activity is forecast to continue during day 1 (07 Mar), with a slight chance of Active intervals given the potential for residual glancing CME influence. Into day 2 (08 Mar) increasingly Unsettled conditions expected with Active intervals likely overnight into day 3 (09 Mar), with a chance of G1/Minor Storm intervals in association with the arrival of the HSS combined with possible effects of the glancing CME from the filament lift-off on the 05 March, elevated conditions perhaps continuing into day 3 (09 Mar) before likely easing into day 4 (10 Mar).

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to persist at background levels. GOES16 high energy electron flux is expected to remain at mainly background levels, with the associated 24hr fluence remaining well below the Active threshold.

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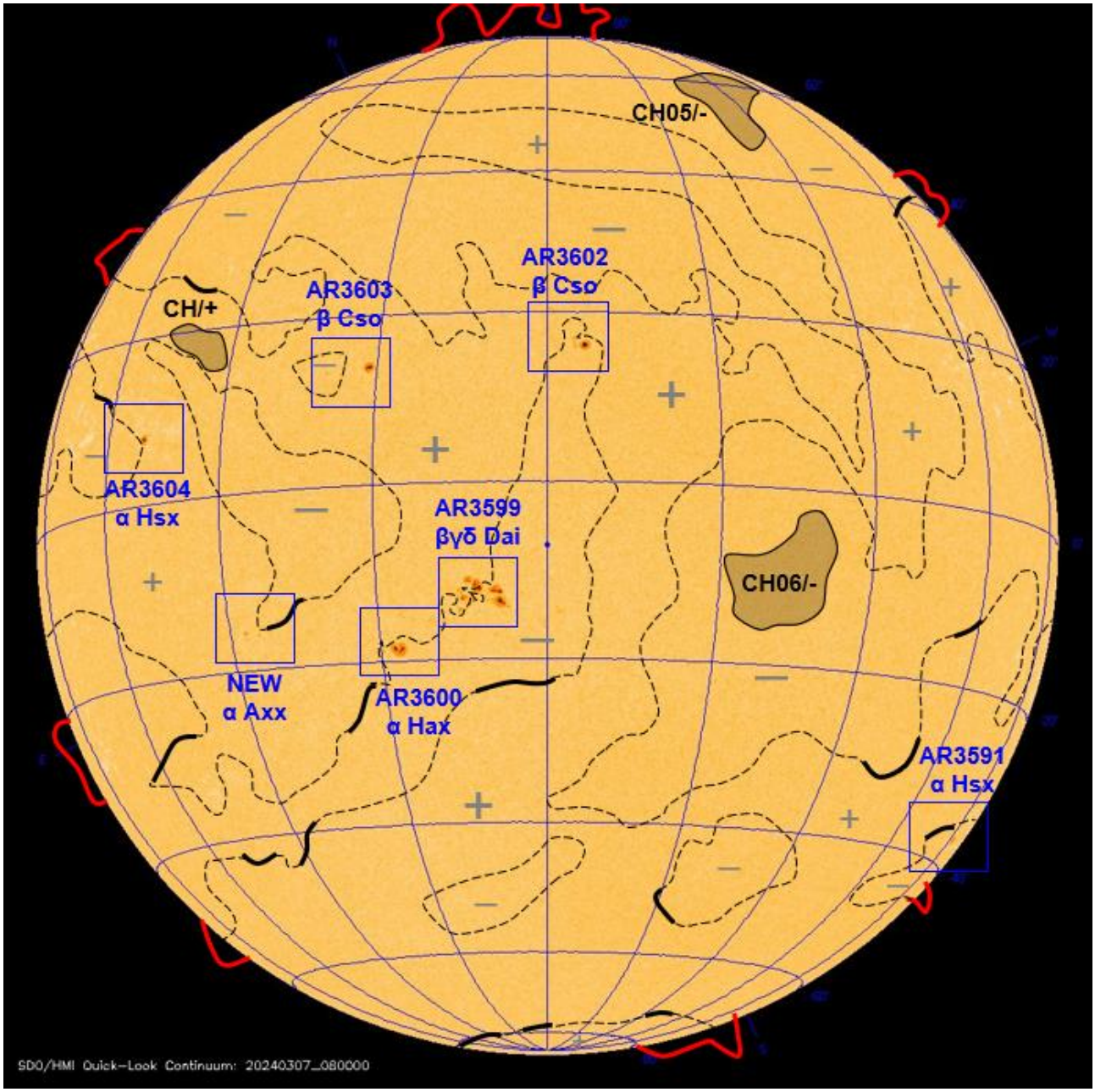
Figure 1. Solar Analysis Valid 07/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME, originating from filament lift off in the southeast disk on the 05 Mar, has been assessed as providing a risk of a glancing blow later on day 2 (08 Mar) or into early day 3 (09 Mar) although the majority of the CME is expected to pass below and behind Earth's orbit. Otherwise the Earth is in a reasonably slow-ambient solar wind environment with the next main enhancement expected from a negative polarity coronal hole, CH06/-, currently moving into the western disc. This is forecast to connect with Earth sometime later into day 2 (08 Mar) and persist into day 3 (09 Mar), with solar winds perhaps reaching elevated levels although confidence is reduced as this feature was not present on the previous rotation. Geomagnetic activity from this feature could see a greater risk for a strong connection as Earth moves closer to the March equinox.

Generally Quiet to Unsettled geomagnetic activity is forecast to continue during day 1 (07 Mar), with a slight chance of Active intervals given the potential for residual glancing CME influence. Into day 2 (08 Mar) increasingly Unsettled conditions expected with Active intervals likely overnight into day 3 (09 Mar) with a chance of G1/Minor Storm intervals in association with the arrival of the HSS combined with possible effects of the glancing CME from the filament lift-off on the 05 March, elevated conditions perhaps continuing into day 3 (09 Mar) before likely easing into day 4 (10 Mar).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	30	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
06/0210	Partial	Filament eruption	SE	790km/s	09/0000UTC	Glancing blow possible

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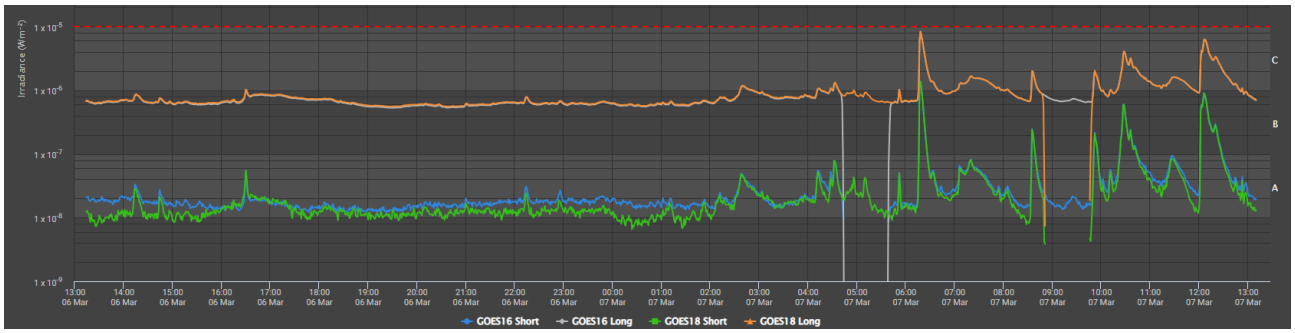
Radio Blackouts - X-Ray Flares:
Low activity is expected, with a slight chance of isolated Moderate activity maintained throughout. The current most likely source of flare activity, AR3599, remains on the visible disk throughout. Far side soundings do not currently suggest any major oncoming regions expected during the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: Latest 24hr GOES18/16 X-ray trace showing increase in activity, largely associated with AR3599.



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Solar Radiation Storms - (High Energy Protons):
GOES-18 proton flux is currently at background levels, and is expected to remain so through the period in the likely absence of significant western hemisphere sunspot flare activity. There is a slight increase in risk toward the end of the period as the current most magnetically complex sunspot region, AR3599, increasingly moves into the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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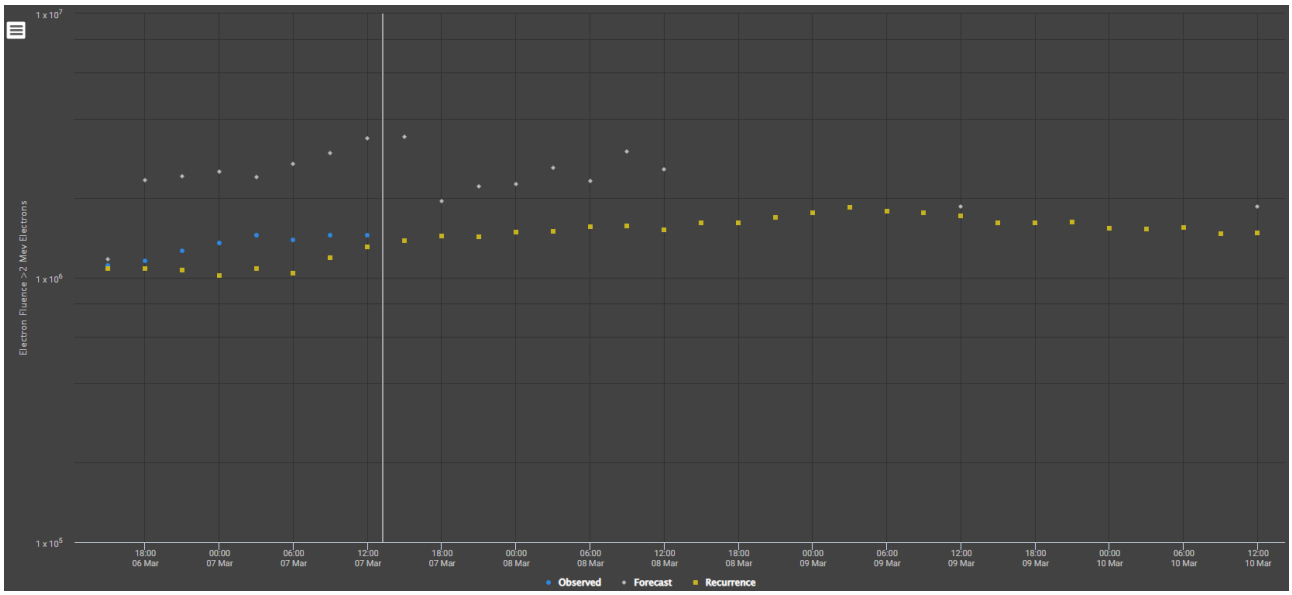
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) remains at background levels despite CME influence in recent days and it expected to generally remain so through much of the forecast period. Any enhancement as a result of CME or coronal hole high speed stream influence are likely to be towards the end of this four-day guidance period.

Consequently, the electron fluence is expected to remain well below the Active threshold with MOSWOC REFM model output viewed as providing reasonable guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output



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